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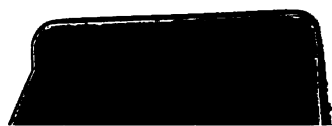
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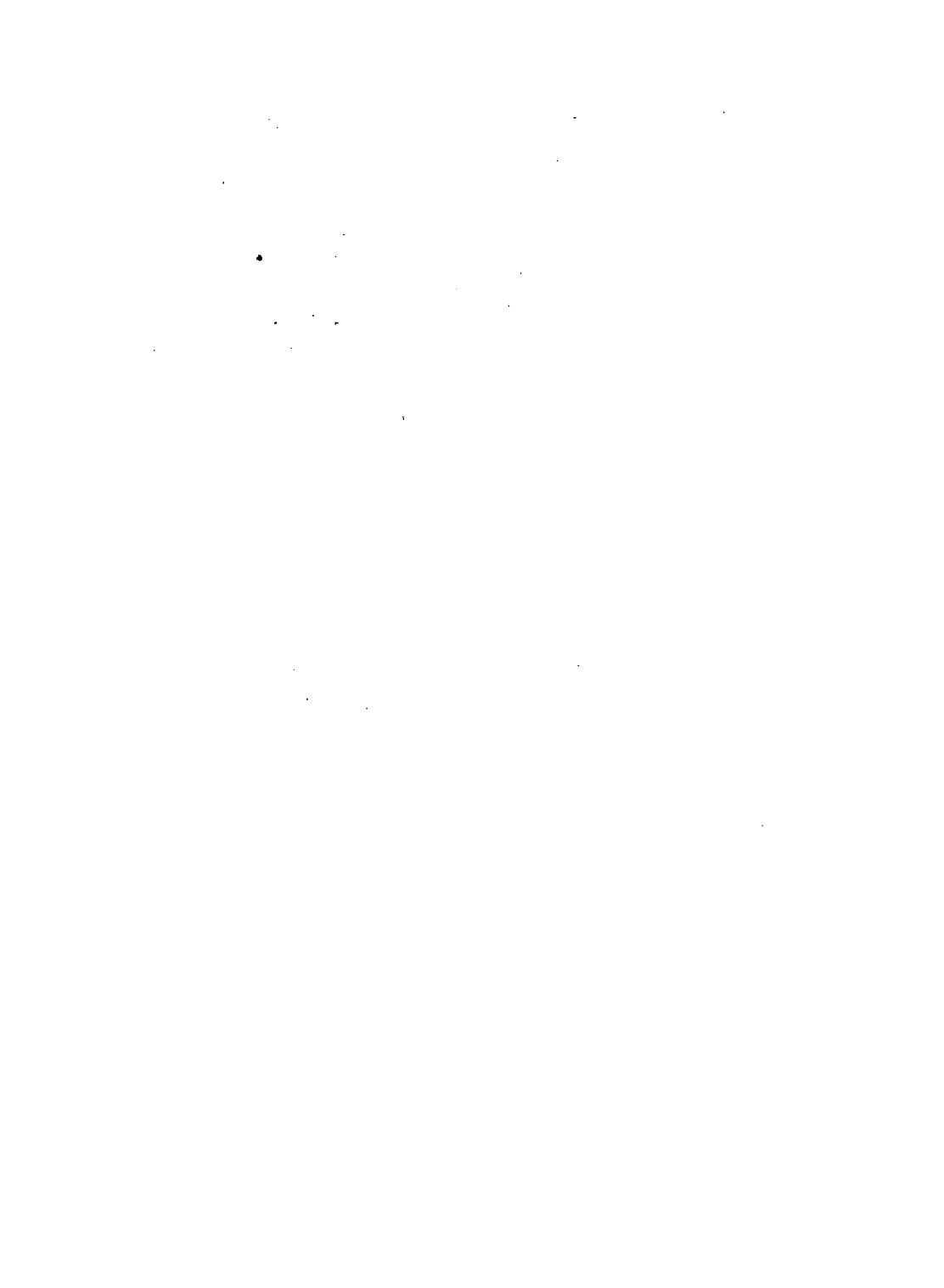
ON
FAILURE OF BRAIN POWER

JULIUS ALTHAUS, M.D.

THIRD EDITION.







ON
FAILURE OF BRAIN-POWER.

BY

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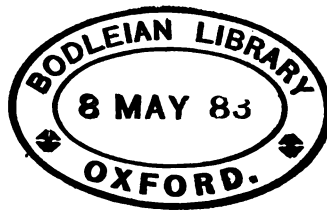
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PREFACE.

Two editions of this little book having been sold out in a few months, I have not thought it necessary to make any alterations; but I have, at the request of some of my professional brethren, added a number of engravings, in order to facilitate the comprehension of the text.

48, HARLEY-ST., CAVENDISH-SQ., W.
~~80, DRYDEN-STREET,~~
~~MARBLE ARCH, W.~~

November, 1882.

ON

FAILURE OF BRAIN-POWER.

RECENT physiological and pathological researches on the localisation of functions and faculties in the brain and spinal cord have thrown considerable light on the nature and mode of production of many of the most important diseases to which the nervous system is liable, such as the various forms of paralysis, epilepsy, insanity, and others; and it appears to me that they may also serve to furnish us with a key to the more accurate definition of those very frequent, although less serious, functional disorders which have from time to time been comprehended by the names of hypochondriasis, nervousness, nervous exhaustion, neurasthenia, spinal irritation, neurosis, neuropathy, etc. Morbid states of the nervous system, in which there is failure or perversion of energy without organic disease of nervous tissue, have unquestionably always existed, but have recently, in consequence of altered conditions of life and the greater severity

of the struggle for existence, become more frequent, and have therefore attracted the attention of physicians to a greater degree than formerly. Briquet, Bouchut, Fordyce Barker, Erb, Beard, and others have shown that the symptoms of neurasthenia frequently simulate those of organic disease, and given a more or less detailed description of them and their common causes ; but no one has as yet attempted to trace the different symptoms which are clinically observed to their special sources, or shown them to originate from impaired nutrition of specially defined areas of the brain and other portions of the nervous system. For this reason the description of symptoms has been somewhat disjointed, and the treatment of the disorder has not been pursued in sufficiently strict accordance with its localisation.

Diseases of the eye, throat, womb, etc., are at the present time treated chiefly, although not exclusively, by local remedial measures ; and while oculists, laryngologists and gynæcologists have no doubt occasionally been guilty of a degree of exaggeration as regards local interference, yet success has on the whole been proportionate to the skill with which local treatment has been devised and carried out. The same tendency is perceptible in the modern treatment of diseases of the lungs by inhalation, etc. On the other hand, the purely

constitutional treatment of local disorders has been carried to a foolish extent, and resulted in such notorious solecisms as sending patients on a voyage to Australia for improving their stamina and constitutional powers, when all they wanted was a pair of suitable spectacles !

While fully conscious of the importance of constitutional conditions in the production of nervous diseases, and of the value of constitutional treatment in the same, more especially where the presence of one of the more important dyscrasiæ, such as syphilis, gout, malaria, struma, etc., can be ascertained, I have yet long been of opinion that many apparently constitutional or general diseases of the nervous system are in fact local affections of certain areas of nervous matter, and require local treatment as much as other local maladies. I have therefore, in cases which have appeared to me suitable, endeavoured to carry out this idea ; and some of the results thus obtained I have recorded in "Brain" for October, 1880, and April, 1881. In the present essay I purpose to treat of certain functional diseases of the brain, which have as their characteristic feature *loss of power* (asthenia) in different spheres of the organ, and of the localised application of the constant voltaic current for their cure.

The brain is not, as was formerly believed, a single organ which acts as a whole, but consists of

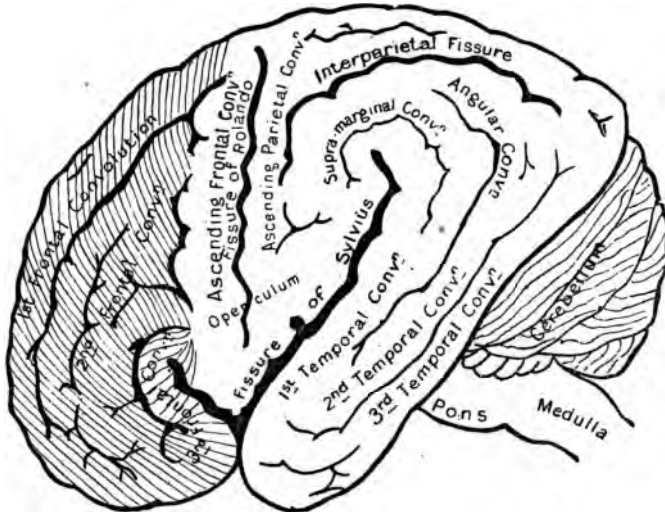
a number of different portions or departments, all of which are in the most intimate connection with each other, yet each of which has its own special structure and configuration, and is endowed with entirely different faculties. All the several parts of it may suffer from failure of power, separately or collectively, which explains the great variety of symptoms met with in practice ; and I shall now proceed to consider them seriatim, beginning with the highest and most important part, viz., the frontal lobes, which appear to be more frequently affected than any others.

1. THE FRONTAL LOBES.

The frontal lobes, which consist of the first, second, and third frontal convolutions, constitute the *material base of all our intellectual and moral manifestations*. Congenital absence or deficiency of these parts is connected with the various forms and degrees of idiocy and imbecility ; and disease of, or injury to, them later in life, profoundly affects the moral and mental faculties of the person concerned. The frontal lobes are absent in the lower forms of animal life, become gradually more developed in the higher species, and are largest in man. An unusual development of them coincides with the highest development of intellectual power, such as

we see it in great orators and statesmen, authors, artists, inventors, physicians, and merchant princes. The frontal lobes enable us to fix our attention on any given subject, and to concentrate our conscious-

FIG. 1.



Lateral view of the Brain. The frontal lobes shaded.

ness—such being an indispensable condition for the highest order of mental activity. They enable us to distinguish right from wrong; they control and restrain the lower centres, which, by giving us sensations and desires, incite us to the performance of certain actions; and without their ruling power

we should be unable not only to perform any of the higher intellectual operations which fall to our lot in life, but likewise to restrain our animal impulses, so that without them society could not be kept together. Where their influence is temporarily in abeyance, as in epileptic vertigo or automatism, murder, rape, and arson may be committed on the slightest provocation.

The frontal lobes are subject to the same structural diseases as other portions of the brain, viz., hæmorrhage, softening, tumours, and inflammation; but they may also suffer from simple loss of power without organic disease, when we assume a disturbance of molecular nutrition in the grey nerve-cells of which they consist. This may be brought about by various causes, some of which are intrinsic, while others are adventitious. An unstable nervous system transmitted from parent to offspring; excessive mental exertion; sexual irregularities and excesses, more especially masturbation; the worry and anxiety inseparable from a high state of civilisation; and some of the acute diseases, such as small-pox, typhoid fever, and scarlet fever, have appeared to me to act as the most frequent causes of this condition. Age seems to have but little influence, as this asthenia occurs at almost any time of life between 15 and 70 years; while, as regards sex, males are more commonly affected than females.

A circumstance which has struck me particularly is that the majority of my patients were bright and clever persons, in whom, therefore, an originally large development and good nutrition of the suffering parts might be presumed to have primarily existed.

Loss of power in the frontal lobes shows itself clinically, chiefly by a difficulty in fixing the attention and making sustained mental efforts. The mind is not settled, and is either in a state of restlessness and unsteadiness, or of drowsiness and apathy; while sometimes these two opposite conditions are found to alternate. The patient cannot settle down to his habitual occupation; he cannot read a serious book, or follow an argument which requires more than passing attention; if he does the work he does it badly; he has a difficulty in composing a letter or adding up a column of figures; his thoughts are apt to wander in different directions; there is a kind of day-dreaming; an occupation is begun, but shortly afterwards there is an intermission of intellectual activity, the patient staring vacantly and doing nothing. In many cases there is utter indifference to, and absolute distaste for, intellectual work and occupation; while in others there is the keenest desire for it, yet the power to devote oneself to the same is absolutely lacking, and all efforts towards it prove unavailing.

I will now relate a few cases as briefly as possible, which will serve to illustrate this pathological condition.

CASE 1. — In December, 1880, Dr. Thorowgood asked me to see an unmarried lady, aged 25, who had been in good health until her father was seized by a serious illness which required constant attention and nursing, while she had at the same time the charge of a sister who had a most violent temper, and was slightly deranged. These troubles gradually told upon her strength; and when there was no longer any occasion for the services which she had so long and faithfully rendered, and she wanted to return to her favourite occupations, she felt herself utterly incapable of going on with them for any length of time. She had been a student at the School of Art, and was very fond of painting; but when she attempted to do it, she got such fearful feelings of unsteadiness and discomfort in her head that she was obliged to lie down, and keep perfectly still. Nor could she play the piano, in which she had formerly excelled; nor read a whole page of a book at a time. When she received a letter she often kept it a whole day in her pocket without venturing to open it, and ultimately asked a friend to read it to her. She disliked society, and even the ordinary conversation in the family circle was too much for her. She could only sit up for a

very short time, and mostly spent the day lying on a couch. There was not the slightest symptom of hysteria or affectation about the patient, who, on the contrary, suffered intensely from her enforced idleness, as she was ambitious and desirous of distinguishing herself. Cranial percussion elicited tenderness in the region corresponding to the frontal lobes. Otherwise there were no symptoms of disease, showing the case to be one of pure asthenia of these parts. This view was confirmed by the further progress of the case, which was favourable.

CASE 2.—An undergraduate, aged 22, consulted me in March, 1880. He had begun, when quite a boy, to practise masturbation to excess. At the age of fifteen he began to feel the ill effects of the habit, chiefly by perceiving a great difficulty in fixing his attention, and attending to his work: which he had done formerly without any trouble. He also felt wretched and unhappy, and this induced him to discontinue the habit. During the last seven years he had undergone the greatest moral tortures, gradually getting more exhausted and incapacitated. He felt what he called "symptoms of approaching insanity," which it was his constant and painful endeavour to conceal from his friends; and a formerly brilliant intellect had been reduced to a barely respectable mediocrity. He seemed to be

worst when alone, but was likewise wretched in society. His memory was very much impaired. He suffered from frontal headache, chiefly in the morning; could not read a book; was fond of music, but had a difficulty in playing on the piano, as his fingers were unsteady, and for the same reason he habitually cut his face while shaving; he had a timid and unhappy expression, which struck me particularly in so young and handsome a man. He said that the doctors whom he had consulted had attributed everything to fancy, while he felt his miserable condition to be a real fact. There was tenderness on cranial percussion, but no other symptom of disease.

CASE 3.—A baker, aged 54, married, and father of several children, came under my care at the hospital in June, 1877. He had been a hard-working man, successful in business, and cheerful and bright in temperament. For the last six months, however, his condition had gradually become entirely changed. He now felt the utmost indifference and want of interest in anything that concerned him: in fact, as he expressed himself, he cared for nothing at all. He often felt so drowsy that his friends thought he had been drinking, although he was perfectly abstemious. He was worst in the morning, and would sit a long time on the edge of his bed, staring vacantly before him,

and forgetting to dress himself. He passed his day in doing nothing, and could not fix his attention on the most ordinary occurrences in his business.

The frontal lobes being likewise the seat of intelligent language, it is not surprising to find that patients suffering from asthenia in them should occasionally exhibit a difficulty in expressing themselves intelligibly; but as that function is seated in a limited area of these lobes—the foot of the third left frontal convolution and its immediate neighbourhood—this symptom is absent in a number of cases. In others, however, it is very marked. The patient cannot finish a sentence, breaks off abruptly in the middle of it, and substitutes one word for another. This latter peculiarity is by many looked upon as a sure sign of incipient softening of the brain; but I have observed it in a sufficient number of cases of frontal asthenia to be able to say that it may be owing simply to temporary exhaustion of the centre of language, without structural disease. Another peculiarity is that persons in this condition, who have been familiar with several foreign languages, have sometimes the greatest difficulty in expressing themselves in French or German, when English comes quite easy to them.

Sustained efforts in public speaking may be-

come impossible to those who had previously the greatest facility in addressing public assemblies.

CASE 4.—A gentleman, aged 68, who had long had a brilliant reputation for the peculiar incisiveness of his intellect, the phenomenal character of his memory, and his great oratorical powers, consulted me in July, 1880. He had for about twelve months past noticed that he could not talk so fluently as before, and on a recent occasion when he had to make a speech he got well to the end of the first part of it, but then could not, for the life of him, proceed with the second; in fact, he broke down altogether, not only losing the thread of his argument, but also the power of expressing himself fluently, so that, “after humming and hawing for a time,” he had ultimately to sit down, to his great mortification, with some stupid remarks on the diffidence he felt in addressing so distinguished an assembly—a diffidence which he was very far from feeling. He also found that he was apt to forget long conversations which he had quite recently had on important subjects; he could not remember the names of streets in which his friends lived; and easily forgot what he had been reading. He complained of his head feeling empty, “as if the brain were wasted or in a state of liquefaction.” He could still talk brilliantly on occasions, but did not

write such good letters as he used to do, and made occasional mistakes in spelling. In a letter from him which I have before me, he writes: "I will call on you the *first time* I have *time* to spare" (leaving out all the dots on the i's). His physical health was excellent; his muscular power, as tested by the dynamometer, and by the varied and sustained exercise he took, remarkable; and his appetite and digestion had never been better. His age made me suspicious that softening of the brain might be creeping on; but as his heart and arteries did not show the signs of degeneration usual in such cases, and as there was an utter absence of other significant symptoms in the spheres of motion and sensation, I concluded that he was suffering from frontal asthenia, an opinion which was confirmed by the good results of the treatment to which he was subjected.

The faculties of talking and writing are by some believed to reside in a common centre; but it is more probable that there are two separate centres for them, which are however in the closest proximity to one another. In asthenia of these parts, writing may undergo a similar change as talking. Sometimes the character of the handwriting is altered; there seems to be an impediment in it; more time and trouble are required in forming the letters; words are either left out or repeated twice over,

others are put in which are not wanted, and mistakes are made in spelling, which greatly astonish the patient when his attention is called to them. In copying a sentence from a letter or a book the patient looks incessantly to the original, as he cannot take in more than two or three words at a time.

Irritability, or even irascibility of temper is another symptom of this condition. In many persons undue mental excitability is habitual, and therefore no sign of disease; but in the cases now under consideration there may be a decided and somewhat suddenly produced alteration of an habitually placid temper.

CASE 5. A merchant, aged 47, had generally been in good health, and had been a particularly good tempered man, but, after great and prolonged exertion in business two years ago, "from having been a lamb, had become a tiger," more especially in his domestic relations. The least thing upset him so much that he was quite beside himself, and he became violent on the slightest provocation. He felt sorry for such outbursts of temper afterwards, but was utterly unable to restrain himself at the time. His intellectual powers had diminished; he was not so keen in seeing his chances in business as previously, and had lost large sums of money in consequence. His memory, more especially for

names, had become worse; he slept badly, and drank ale and brandy in bed to procure sleep. The conjunctivæ of the eyes were bloodshot, and digestion was impaired, but evidently from abuse of stimulants only. There were no other symptoms of disease.

Sleeplessness is of tolerably common occurrence in the condition which we are now considering. Sound sleep is impossible without complete suspension of the activity of the highest cerebral centres, viz., the frontal lobes. The spinal cord does not sleep, for the sphincters remain active throughout the night; indeed, the reflex action of the grey centre of the cord is then rather increased, for many patients suffering from locomotor ataxy, who have incontinence of urine during the day, retain the water perfectly while asleep; and erections occur in sleep long after they have ceased to take place in the waking condition. The medulla oblongata likewise does not sleep, but acts less energetically in the night, for although respiration and the heart's action continue without interruption, these functions are not so active as during the day. The parts of the brain which do really sleep are therefore chiefly the emotional centres in the meso-cephale, and the whole of the grey surface, including the centres for motion, sensation and consciousness. The object of sleep being to remove products of

waste from the nervous and muscular systems which have accumulated during the day ; to repair the losses caused by work and exercise in the tissues, and to store up a fresh supply of intra-molecular oxygen for next day's consumption, protracted loss of sleep soon causes great exhaustion of nervous power, especially when combined with restlessness at night. Where the patient, without actually sleeping, is yet restful, this condition may however continue for an indefinite time.

CASE 6.—A merchant, aged 37, consulted me in January, 1877, for sleeplessness, from which he had suffered ever since the age of 21, when he had had a bad attack of small-pox. He had also practised masturbation since the age of 15 years, and only discontinued the habit about two years ago. Before he had small-pox he could go to sleep at any time, and continue to sleep as long as he liked ; but on recovering from that distemper he found that he had a difficulty in going to sleep. He used to lie awake at first five or ten minutes, then half-an-hour and more, before he fell asleep ; and he thus gradually passed into his present condition, in which he really did not sleep at all, and although lying still was nevertheless quite conscious throughout the night, heard every cab which passed his house, and could get up at any moment. Towards 6 A.M. this condition became somewhat more of a real doze ;

before that time it was not even that. This made him so wretched and miserable that he felt life was not worth having; and "he had reasoned it out that suicide would be preferable to going on living in this manner." He also complained of crawling sensations in the forehead and bridge of the nose, a feeling of pressure on the head, and occasional attacks of acute pain in it. His mental energy, which had previously been considerable, was now much impaired, but his physical health was good.

Many persons imagine that they have had little or no sleep when they have really had several hours' fair sleep; but in the case just related the patient was so intelligent, and had cultivated his powers of self-observation to such a high degree, that the correctness of his statement could not be questioned.

The diseases with which loss of power in the frontal lobes may be confounded are chiefly softening of the brain, tumour, and general paralysis of the insane in their initial stages. The diagnosis of these different conditions is often a matter of great difficulty, and can only be arrived at by a most careful examination of all the various features of the case. Every organ should be thoroughly examined, symptoms which may be absent being quite as important as those which may be present.

I shall now treat of the most salient differences in the diseases which have just been mentioned.

A.—SOFTENING OF THE BRAIN.

This is owing to occlusion of the bloodvessels, in consequence of which the brain-tissue can no longer be supplied with nourishing material, and therefore undergoes incurable degeneration—local death—unless collateral circulation be quickly established. It may occur suddenly through embolism, or gradually through thrombosis. The embolic form of softening, in which there is mostly a sudden attack of apoplexy and paralysis of one side of the body, can, therefore, not be confounded with asthenia; but that form of softening which is owing to thrombosis, and in which the bloodvessels of the brain become gradually constricted and plugged, causes signs which, in the commencement, singularly resemble those of simple loss of power. The patient with softening, complains of a bewildered and confused feeling; the memory is impaired; there is difficulty in fixing the attention and in talking. Giddiness and swimings in the head are frequently experienced, and there is headache, which may be felt in the entire head, or more particularly in that portion of it which corresponds to

the affected area of the brain. There is numbness, "pins and needles," and chilliness in one side of the body, or in one side of the face, one arm, or one leg. As the disease advances, one or more of the muscles of the eyes become paralysed. There is awkwardness in using the fingers, chiefly for writing, dréssing, drawing, &c. ; the gait is tottering, and the foot may drag on the ground. Ultimately, when an important artery has become entirely plugged, there is an attack of paralysis, which then resembles, in almost all its features, the paralysis from embolism or from the rupture of a bloodvessel in the brain. Softening from thrombosis occurs chiefly in the aged, partly from failure in the heart's power and partly from the degeneration of the bloodvessels which is peculiar to old age ; but it may also come on in the young, when the heart has become weak and dilated in the course of acute exhausting diseases, such as small-pox, typhoid fever, and scarlet fever, from syphilis, and after excessive exertions and privations. Age alone is therefore not a distinctive diagnostic feature. In softening from thrombosis, however, the initial symptoms rarely last longer than a few months, while similar symptoms in asthenia may last for years, and yet do not lead to paralysis.

B.—TUMOUR OF THE BRAIN.

This may also, at an early period of its existence, be confounded with simple loss of power. Tumour of the brain is often caused by injury, such as a blow or fall on the head, or it may be cancerous, tubercular, or syphilitic, or owing to parasites. Tubercle in the brain is generally a disease of children or young persons, and commonly associated with tubercular consumption of the lungs. Cancer rarely occurs before thirty, and mostly after fifty years of age; while syphilitic tumours, and those which are owing to injury of the head, may occur at any time of life.

The first growth of a tumour is often indicated by a feeling of general *malaise*, want of energy, irritability of temper, and drowsiness. The patient is depressed in spirits, inclined to be lachrymose, indifferent to the events of daily life, and wishes to be left alone. The memory is impaired, and there is a difficulty in fixing the attention. Headache is a prominent symptom, and may affect, as in softening, the entire head, or chiefly that part of it which is the seat of the tumour. It varies from a simple feeling of soreness, fulness, or heaviness, to the most agonising pain, which sometimes causes the patient to faint away and lose consciousness for a long time. It is mostly frontal, and increased

by pressure, percussion, and reflex movements, such as coughing and laughing, by movements of the head, and by light and noise. There is also giddiness, which is often severe; attacks of vomiting, and failure of sight from optic neuritis supervene after a time. An examination of the eyes by the ophthalmoscope is therefore a most important help to diagnosis. Loss of smell when the tumour is seated in front; double vision and strabismus when it presses on the third, fourth and sixth cranial nerves; deafness, loss of taste, various forms of neuralgia, difficulty of swallowing, and a ravenous appetite, may also be present. Epileptiform seizures generally come on sooner or later, and may appear either in the form of general convulsions and loss of consciousness, or as spasm in the muscles of one side of the face, or the corresponding hand and foot. Towards the end there is either complete imbecility, or attacks of mania with delusions and hallucinations, extreme emaciation and general paralysis, and the patient dies comatose. Tumour of the brain can therefore only in its earlier stages be confounded with simple loss of power.

C.—GENERAL PARALYSIS OF THE INSANE.

This arises from a diffuse chronic inflammation of the brain and spinal cord, and may in the beginning likewise resemble asthenia. Mental ex-

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citement is often one of the first symptoms. The temper is irritable; the memory impaired, chiefly for recent occurrences and names; and giddiness and headache are complained of. The patient becomes odd in his manners; he loses his self-control and reasoning powers; the speech is affected, and sometimes assumes a nasal twang; there may be stammering, which, however, can be overcome by an effort of the will. The pupils are unequal, one being larger than the other, or they may both be very narrow. The optic disc is, by the aid of the ophthalmoscope, seen to be in a state of congestion. A peculiar quivering or twitching motion about the lips and the face generally is an important sign, as this is hardly ever seen in asthenia. This stage of the disease may last for several months, and then further symptoms make their appearance. There is loss of motor power, but not so much as to amount to paralysis. The speech is thick, like that of a drunken man, and sometimes quite unintelligible. The saliva runs away, the expression is vacant and silly, the tongue is put out with difficulty, and appears tremulous when protruded. There is tremor in the hand; the patient cannot feed or dress himself properly, and a great change in his handwriting is apparent. The walk is peculiar, and may give the impression of the patient being drunk. The mind gradually fails more and more; the patient

becomes quite unable to manage his business, or if he does attend to it, makes fatal mistakes, which may ruin him and his family. He loses all ideas of the value of money, and signs away large sums for trumpery things. Delusions occur which have an exalted and ambitious character. He has become a king or an emperor, lives in a palace, and has a revenue of a million sterling. Perverse impulses are occasionally developed, and the patient may commit theft, arson, and murder. In the last stage of the disease there is paralysis of motion and imbecility; and it will therefore be seen that, as in tumours, only the commencement of general paralysis can be confounded with asthenia. The former disease rarely lasts longer than two years, while the latter may be almost indefinitely protracted.

Some of the points relied upon by Dr. Beard,* of New York, for the diagnosis between functional and structural disease of the nervous centres are most misleading, and if acted upon in practice would lead to utterly erroneous views as to the nature of an individual case. Thus he makes the astounding statement, that "in organic disease, reflex activity is generally diminished; in functional disease, reflex activity is generally increased." Such an assertion can only be explained by assuming its author to be

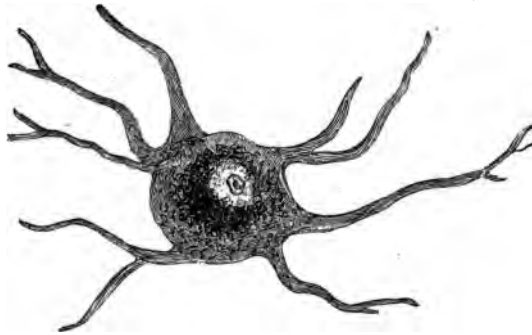
* "A Practical Treatise on Nervous Exhaustion" (Neurasthenia). Second Edition. New York, 1880, p. 92.

insufficiently acquainted with the ordinary clinical features of nervous diseases, since just the reverse is the fact for the immense majority of cases of brain disease which come under our care ; *for, other things being equal, loss or diminution of cerebral influence by organic disease, such as hæmorrhage, softening, tumour, etc., increases very generally the superficial, and almost invariably the deep reflexes, while both kinds of reflexes are generally normal in functional derangements of the nervous centres.*

What is the precise condition of the nerve-cells in asthenia of the frontal lobes ?

We know these lobes to consist chiefly of grey

FIG. 2.



Ganglion-cell from the human brain, with nerve-fibres proceeding from it in various directions.

cells in which the nervous force is generated and accumulated, and which are connected with tubes

or fibres proceeding from the cells in various directions, so as to conduct the force to other parts. The grey cell may therefore be appropriately likened to a galvanic battery in which an electric current is generated, and the fibres proceeding from the cell to conducting wires which transmit the current to any place where it may be required. Now it appears to me that the laws which govern the action of the grey nerve-cells are very analogous to those ruling the action of electricity. The principal law of electricity is that known as Ohm's law, so called after the German professor who first enunciated it; and this is to the effect that the current-strength is equal to the electromotive force, divided by the resistance which it encounters in the circuit of the battery. Now, the power of the central grey nerve-cell may be expressed similarly by saying that the nervous energy which is manifested is equal to the force evolved divided by the resistance which it experiences within the cell. The active state of the galvanic battery, as well as of the central grey nerve-cell, is therefore owing either to increased production of force or to diminished resistance, and their dormant state is due either to diminished force-production or to increased resistance. Just, therefore, as the current of a galvanic battery may be modified by changes in the electromotive force, or in the resistance, or in both,

thus any alteration in the manifestation of nervous energy, such as we meet with in various disorders of the nervous system, may be accounted for by changes either in the nervous force, or in the resistance, or in both.

This analogy might be carried still farther by comparing the resistance which, in a galvanic battery, is called external or non-essential, and which is encountered by the current on its passage through different conductors, as distinguished from the internal or essential resistance which is offered to the current in the battery itself—with the external or non-essential resistance which is offered to the nervous force, when travelling from the central grey cell through the white conducting fibres in the brain, spinal cord, and peripheral nerves, and that at any portion of these conducting strands.

The formula for Ohm's law of electricity being $C = \frac{E}{R}$, that is, the current-strength is equal to the electromotive force produced, divided by the resistance which it encounters in the battery itself and when travelling through conductors—I would propose the formula $N = \frac{F}{R}$ for the action of the central nerve-cell; that is, the nervous action manifested is equal to the nervous force which is evolved

in the grey cell, divided by the resistance which it encounters within the cell itself, and when travelling through the white conducting fibres.

In asthenia it has been generally assumed that the production of nervous force is diminished, and no account has been taken of resistance; but the symptoms observed in many cases seem rather to point to unduly increased resistance than to diminished force-production. *Force is still there, but it cannot be utilised by the patient, since he is unable to overcome the resistance offered to its liberation.* These observations seem to open up a new vista for the explanation of numerous nervous disorders, and the subject is well worthy of further investigation.

There can be little doubt that certain changes in the production of force, as well as in the resistance offered to its manifestation, depend upon certain changes in the nutrition of the nerve-cells, which must be intimately connected with the supply of blood and intra-molecular oxygen to the same. Any agent, therefore, which would favourably modify these nutritive changes, would be likely to be therapeutically useful in asthenia. It has been experimentally shown that the calibre of the cerebral arterioles may be changed by the passage of the continuous galvanic current through the brain; while clinical experience has convinced us that by such a proceeding the nervous energy may

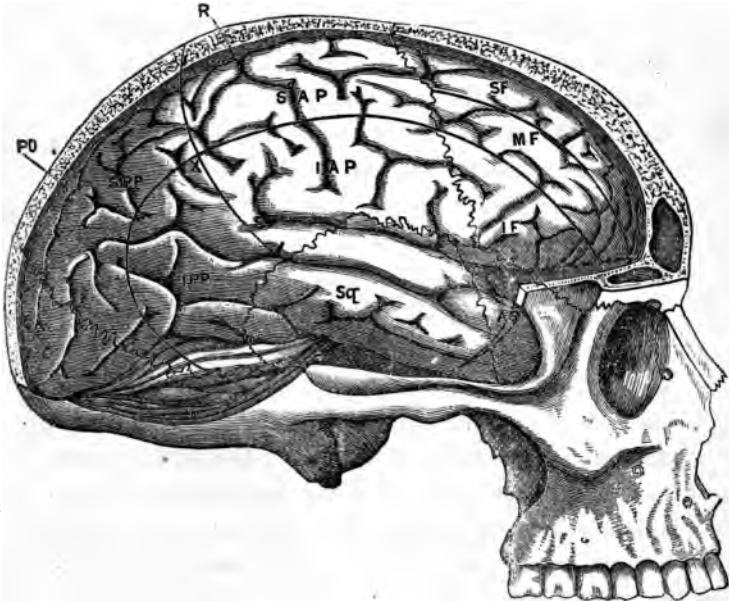
be increased, undue resistance overcome, and a better balance in the functions of the brain be established. Such effects must be in a great measure owing to a modification of the molecular changes which are constantly going on in the nerve-cells, the neuroglia, the blood and lymphatic-vessels, and the fluid in the ventricles and between the membranes of the brain, by the catalytic, electrolytic, and electro-mechanical or cataphoric action of the current.

That a constant current of moderate force when applied to the integument of the skull really traverses the brain, is now admitted by all who have studied the question, and it is therefore unnecessary to adduce further arguments to prove this. In lack of power in the frontal lobes we therefore apply the current to the forehead by electrodes specially moulded so as to adapt themselves well to its surface, and in a number of cases no other application is required. But as the vaso-motor centres in the medulla oblongata and the cervical portion of the spinal cord have a powerful influence on the circulation of blood in all portions of the brain, it is frequently advisable to act on these structures likewise, which is done by putting one electrode to the back of the head, while the other is applied to the forehead.

The exact relations of the convolutions and

fissures of the brain to the surface of the skull are shown in Fig. 3 (after Turner).

FIG. 3.



In this figure, R indicates the fissure of Rolando, which separates the frontal from the parietal lobe; SS the fissure of Sylvius, which separates the temporo-sphenoidal from the frontal and parietal lobes; SF, MF, and IF, correspond to the superior, middle, and inferior frontal convolutions; O is the occipital area of the skull, indicating the

position of the occipital lobe, the letter being placed on the middle occipital convolution; P O is the fissure between the parietal and occipital lobes; S A P corresponds to the superior portion of the motor centres of the hemisphere, A P being placed on the ascending frontal convolution, and S on the ascending parietal convolution; I A P corresponds to the inferior portion of the same area, A P meaning the ascending frontal and I the ascending parietal convolution; S P P indicates the superior and posterior portion of the parietal area of the skull, the letters being placed on the angular convolution; I P P shows the inferior and posterior portion of the same area; X the supra-marginal convolution, the whole of this area being particularly related to the sense of sight; Sq indicates the squamoso-temporal region of the skull, which contains the larger part of the temporo-sphenoidal convolutions or centres of sensation; and A S the ali-sphenoid area, which contains the lower extremity of the temporo-sphenoidal lobe, and corresponds to the position of the centres of smell and taste.

The application of the electrodes should be as much as possible in consonance with these topographical indications, whenever it has been possible to localise the affection in a definite area of the hemispheres.

Carbon thickly covered with fine sponge, which latter must be well moistened with hot water, is the best material for the electrodes. If these have only a thin covering of flannel or chamois leather, as is often the case, and if, in addition to this, their size be small, undue irritation of the skin and the periosteum may be caused, which is not only an unnecessary infliction on the patient, but also shows that the current encounters resistance in its passage through the brain, and does not penetrate the external parts as readily as should be the case.

The conductivity of different persons varies very considerably; and therefore no hard-and-fast rule can be laid down for using so many cells or so many Milliwebers, or as we should now say, in accordance with the nomenclature recommended by the Paris electrical conference, Milliampères. In a general way, however, it may be stated that the current suitable for most cases will be one of ten to twenty Muirhead's, two to six Leclanché's, and one to two Milliampères. The use of a reliable rheostat is indispensable in such applications. The current should flow through the frontal lobes, or through the entire brain, from one to three minutes in one direction, and then for about the same time in the opposite direction; and it is often useful to finish up by some passes with the cathode right across the forehead, more especially where headache and

a feeling of weight or pressure on the head are complained of. This application, if properly performed, is entirely painless.

In most cases of asthenia of the frontal lobes which I have treated in this manner, the results have been extremely satisfactory; and I have therefore no hesitation in saying that the prognosis in them is generally favourable. Thus the patient who was the subject of Case 2 expressed himself shortly after the commencement of the electric treatment, as so much improved that he was hardly like the same man. He said that, for the first time in seven years, he had again felt some pleasure in life; that he could read for hours with comfort, recollected what he had read, had no headache in the morning, had not cut himself in shaving, played the piano much better, and felt altogether more brisk and energetic. This was in January, 1880, when the electricity was applied fourteen times. In June of the same year he wrote to me that "his condition now, to his condition when he first saw me, was as light compared to darkness;" yet he was not so well as he ought to be, and therefore begged me to resume the treatment. On this second occasion the electricity was applied eight times, with most satisfactory results. In January, 1881, I ascertained that the patient had been quite well ever since; "and that in consequence

of my treatment the whole course of his life had been altered."

Again, in Case 4, which appeared *primâ facie* unfavourable on account of the advanced age of the patient, the first application of the current to the head "took away the empty feeling which he had had in it, and he felt an amplitude about the brain which was comforting." In this instance the treatment was continued for six weeks, during which time considerable improvement in mental energy became manifest. The memory also improved, and the flow of quotations became as rich as it had been at any previous time. Five months afterwards I was informed "that the treatment had been completely successful."

It may, perhaps, be said by some that in such and similar cases the sufferings of the patients are purely imaginary, and that the results of the treatment are owing to the impression made by it on the mind. If such an opinion were expressed, I should hardly think it worth while to combat it, since no one who has closely studied and analysed such cases, could possibly entertain it for an instant. It is my deliberate conviction that the sufferings of neurasthenic patients are as real as those experienced by persons affected with tumour of the brain and other structural diseases, and in many instances even more painful and distressing; that a

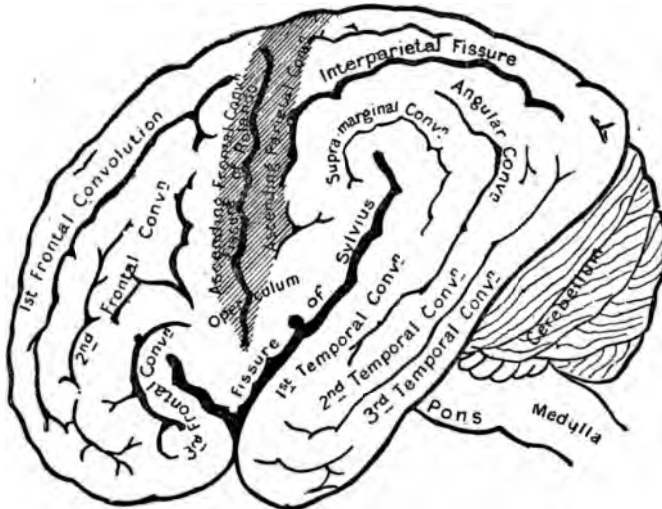
simple impression on the mind cannot and does not, alter their condition ; and that much harm is done by practitioners making too light of these cases, whereby they often compel the patients to resort to charlatans.

With regard to treatment I do not wish to convey the idea that electricity is the only remedy for failure of brain power, nor that it is infallible ; on the contrary, there are frequently indications for the use of medicinal nerve-tonics and alteratives, such as ergot, phosphorus, arsenic, strychnia, iodide and bromide of potassium, nitrate and phosphide of silver, chloride of gold and potassium, etc., and for a general hygienic treatment, change of air and scene, etc. At the same time, I think that no remedy goes so straight to the seat of the disease and acts in such a direct manner as electricity carefully and scientifically administered ; and that this agent is particularly applicable to severe cases which have resisted the influence of other modes of treatment. Indeed, in all cases which have been under my care, a judicious medicinal treatment had already been pursued ineffectually, previous to the use of the voltaic current, and the results obtained were unquestionably owing to the latter.

2. THE MOTOR CENTRES OF THE BRAIN.

The motor region of the brain's surface consists of the grey convolutions surrounding the fissure of

FIG. 4.



Lateral view of the Brain.—The motor centres shaded.

Rolando, viz., the ascending frontal and ascending parietal convolutions,* and corresponds to the anterior portion of the parietal region (SAP and IAP, Fig. 3). They are in intimate connection with the frontal lobes, and also with the lower motor centres, the central ganglia, etc. Both the higher and lower motor centres are liable to failure

of power without actual disease. There is a lack of sustained force in all movements, without paresis or paralysis; great muscular fatigue, with aching pain, after trivial exertions; a sensation of heaviness in all the limbs, which feel like lumps of lead, more especially on waking in the morning. Sometimes the weakness is so great as to amount to paresis or actual paralysis. There may also be a kind of unsettled feeling in the limbs, an inability of repose; the patient cannot sit still in a chair, but has to get up and wander from one room into another, or he cannot bear being indoors, but must go out into the air, etc.

A singular symptom which I would also refer to instability of force in the motor centres, consists of tremors or fibrillary twitches in the muscles. Transitory spasm in the lower portion of the orbicularis of the eyelids is so common that little importance is generally attached to it; but either this or a somewhat different form of tremor is sometimes seen in the muscles of the arms and legs, which is apt to cause anxiety. There are either short and rapid jerks of certain muscles or portions of muscles, which resemble those produced by localised faradisation, and these are particularly apt to occur in portions of the deltoid and biceps muscles of the arm; or there are those more sluggish and crawling muscular twitches which

form such a prominent symptom in progressive muscular atrophy. In two cases which I have seen, the diagnosis of that disease had been made by competent physicians, and an unfavourable prognosis had been given, which caused the greatest anxiety to the patients and their friends. There was however a total absence of wasting, and the further course of the affection showed plainly that it was purely functional. It is therefore important to bear in mind that sluggish muscular twitches do not necessarily point to the development of progressive muscular atrophy.

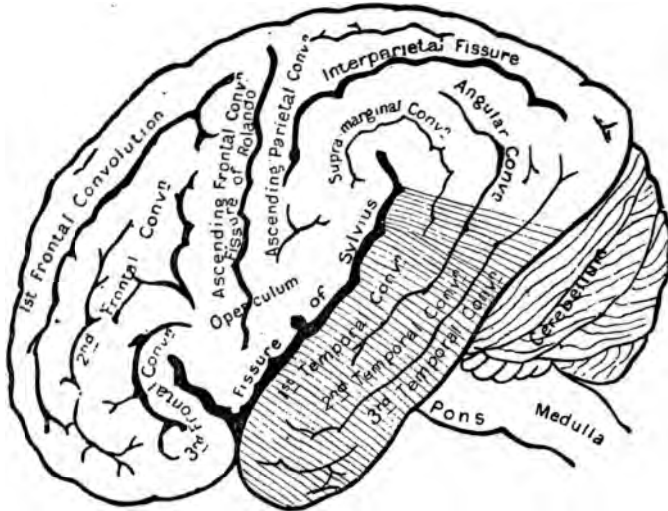
A kind of general tremor, which is apt to occur after excitement, and is habitual in some patients in the morning, especially in the hands, is likewise owing to failure of power in the motor centres; and the sudden jerking of the whole body, or of one or several limbs, which not unfrequently occurs just when one is on the point of going to sleep, has the same pathology. The prognosis and treatment of parietal asthenia are analogous to those of frontal asthenia.

3. THE CEREBRAL CENTRES OF SENSATION.

Centres for the perception of the impressions conveyed by the nerves of special sense are, according to Ferrier's researches, situated in definite

areas of the temporo-sphenoidal and postero-parietal lobes.

FIG. 5.



Lateral view of the Brain.—The temporal lobes shaded.

a.—The Auditory Centre

Appears to be located in the superior temporo-sphenoidal convolution. If it be destroyed in an animal, deafness on the opposite side is the result, while faradisation of the same centre causes the animal to assume a listening attitude. I entertain no doubt that certain cases of *nervous deafness*, which occur without any perceptible disease of the middle or external ear, and which are generally ascribed to

failure on the part of the auditory nerve to appreciate sounds, are in reality owing to loss of power in the auditory centres ; and this view is based on a number of cases in which nervous deafness has been relieved by galvanisation of the temporal lobes. The opposite condition may also occur, viz., *hallucinations of hearing*. These, which are so frequent in the insane, are owing to hyperæsthesia of the auditory centres, and may likewise occur from simple asthenia. The following case, which occurred recently in my practice, is one of considerable interest :—

CASE 7.—A gentleman, aged 38, had for some years past suffered from epileptic seizures, for which he consulted me in February, 1879. His memory had become impaired, but his intellect and judgment were good. One morning he came to me in great distress, expressing an apprehension that he was going to become insane, as for some days past he had been subject to delusions, which had come on without any perceptible cause. He constantly heard voices behind his back, calling him names and speaking in a derogatory manner about his pecuniary affairs and his state of health ; and he appeared to be quite worn out by anxiety on this account. Looking upon this symptom as denoting hyperæsthesia of Ferrier's auditory centres in the superior temporo-sphenoidal convolutions, I applied

the current to the portions of the skull corresponding to these parts, for five minutes consecutively. This gave immediate and thorough relief, as the delusion had completely vanished at the end of the application, and did not return on any subsequent occasion.

b.—The Centres of Smell and Taste.

These are, according to Ferrier, situated close together in the top of the temporo-sphenoidal lobe or the subiculum cornu ammonis. Destruction of this part in an animal causes loss of smell, while faradisation of it is followed by sniffing. It seems rational to assume that the hemi-anosmia of hysterical women, which is part and parcel of the hemi-anæsthesia from which they are so apt to suffer, is owing to a neurosis of this centre. The olfactory hyperæsthesia, which is so frequently seen in certain forms of insanity, hysteria, and as a premonitory sign of epileptic attacks, no doubt arises from undue excitability of the nerve-cells in the olfactory centre, which gradually spreads to the cells of the motor convolutions and tracts, and ends in a convulsive seizure; but I have not observed any symptoms of failure of power in the olfactory and gustatory centres of the brain in asthenic patients.

c.—The Cerebral Centres for Common Sensation.

These centres are, according to Ferrier, situated in the hippocampal regions. Symptoms pointing to failure or perversion of power in them are not uncommon in asthenia. Numbness is frequently experienced, and that in almost any part of the body. There are also sensations of burning heat or icy coldness, pins and needles, stinging like a mustard poultice, crawling, creeping, tenderness, weight or pressure, and a great variety of other morbid sensations. The arms, legs, and the whole body are more apt to "go to sleep" from pressure than in the normal condition, so that the patients are obliged to change their position frequently in the day-time to prevent this kind of numbness, and often wake in the night quite benumbed. Friction and change of position are generally sufficient to overcome this numbness at once. Wandering pains which are sometimes of a neuralgic character, are also apt to occur in almost any part of the body: and cranial tenderness, more especially on the temples and the crown of the head, is common.

d.—The Visual Centre

Is, by Ferrier, located in the angular and supra-marginal convolutions (SPP, IPP and X in Fig. 3,

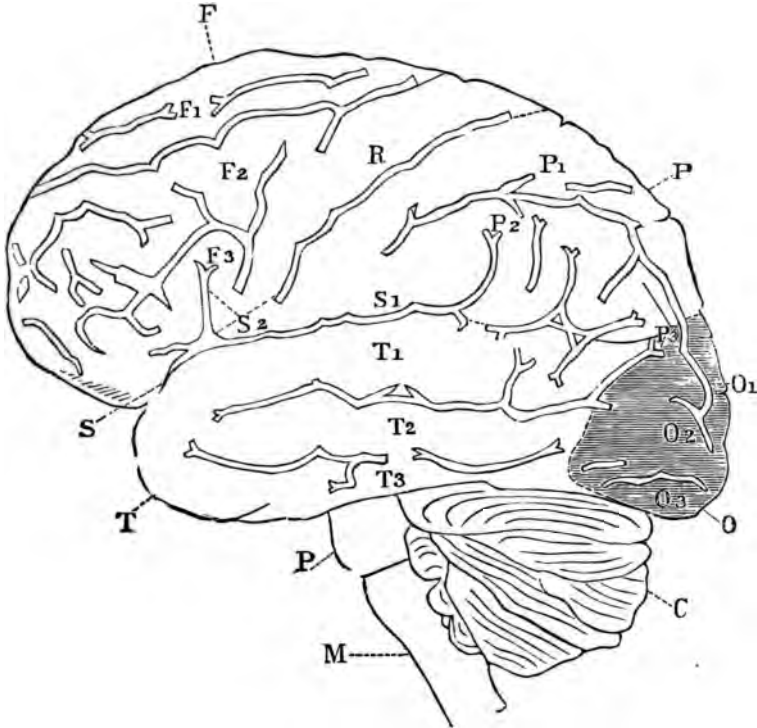
p. 33), and there can be little doubt that in certain forms of *weakness and dimness of sight* where the most careful examination of the eye shows no morbid change, it is this centre which is suffering from asthenia.

4. THE OCCIPITAL LOBES.

There is still much uncertainty regarding the precise functions of these lobes (O in Fig. 3, p. 32), the structure of which differs considerably from the parts more in front, and which receive their blood supply from quite a different set of blood-vessels. They are probably connected with the great viscera, more especially the stomach, liver, and organs of generation, and are centres for the appetite, thirst, and sexual desire, as well as for temper and disposition. Failure of power in them seems generally associated with the various forms of *melancholia*, and loss of appetite and of sexual desire are frequently experienced.

CASE 8.—A married woman, aged 28, had her first confinement in July, 1877. She had until that time been habitually in the enjoyment of excellent health, and been bright and cheerful in her manner, but soon afterwards a complete change in her disposition was observable. She took a dislike to her husband, seemed to lose all interest in the affairs of her home, and became sullen and morose.

FIG. 6.

*Lateral view of the Brain.—The occipital lobes shaded.*

M—Medulla. P—Pons. C—Cerebellum. F—Frontal or anterior lobe of the brain; seat of the intellect. F¹ F² F³—First, second, and third frontal convolution. R—Fissure of Rolando, dividing the frontal from the parietal lobe. S S¹ S²—Fissure of Sylvius. S¹—Horizontal branch of it, dividing the parietal from the temporal lobe. S²—Ascending branch of it, separating the frontal from the temporal lobe. P—Parietal lobe, constituting the motor area of the hemispheres, or the psycho-motor centres. P¹ P² P³—First, second, and third parietal convolutions. T—Temporal lobe; seat of conscious sensations and perceptions; centre for the organs of sight, smell, hearing, taste, and touch. T¹ T² T³—First, second, and third temporal convolutions. O—Occipital lobe; seat of the animal propensities. O¹ O² O³—First, second, and third occipital convolutions.

She refused to go out, and would sit all day long in a corner of her room, doing nothing. If she conversed at all, it was on religious subjects, in which she had previously shown a very moderate interest only; and the only book she would now read was the Bible. She had a settled conviction that she could not be saved, and was doomed to go to hell. When her friends attempted to reason with her, she became only more rigidly fixed in her ideas, and appeared to resent every interference. I first saw her in March, 1878. She had then the expression of a settled frown on her face; the pupils were large; the tongue furred; speech slow and measured. I had much difficulty in inducing her to answer my questions, which she evidently thought impertinent. The appetite was poor, the bowels confined, the catamenia regular. She had never nursed her child. Phosphorus, strychnia, and other nerve tonics were given, but did not afford any relief. She had been taken away from her home for a complete change, but this had done no good at all. After two months of ineffectual medical treatment and regimen, I proposed the application of the constant current. This was directed to the occipital lobes, with voltaic alternatives, for five minutes at a time. An improvement soon became manifest, and when the treatment was discontinued after twenty applications, the whole aspect of the

case appeared altered. The patient still remained more reserved and silent than she had originally been, but she was cheerful, and took more interest in the affairs of daily life. She felt more inclined to take exercise, her appetite had improved, and her ideas on religious subjects had undergone great modifications.

Morbid cravings and desires, which are so frequently present in cases of neurasthenia, are most probably owing to instability of nervous power in the occipital lobes. The craving for drink in its various forms; for tobacco, opium, chloral, bromide of potassium, etc.; for promiscuous and excessive sexual indulgence; for sexual irregularities, more especially masturbation; the ravenous appetite and other forms of craving, seem to occur when the controlling power of the higher intellectual centres is lowered, and those centres which are subservient to animal desires and passions are in an unstable condition. In these cases the pupils are generally much dilated, and respond sluggishly to the action of light; and the conjunctivæ are congested. There is often a movement in a vicious circle, inasmuch as when the craving for drink is indulged in, other forms of craving crop up, and are gratified if the opportunity offers, and thus a state of greater exhaustion is produced, for the relief of which more drink is resorted to. Cases of dipsomania and ex-

cessive spirit-drinking, of opium eating, excessive smoking, etc., which were benefited by the application of galvanism, are recorded in my "Treatise on Medical Electricity," 3rd edition, p. 495.

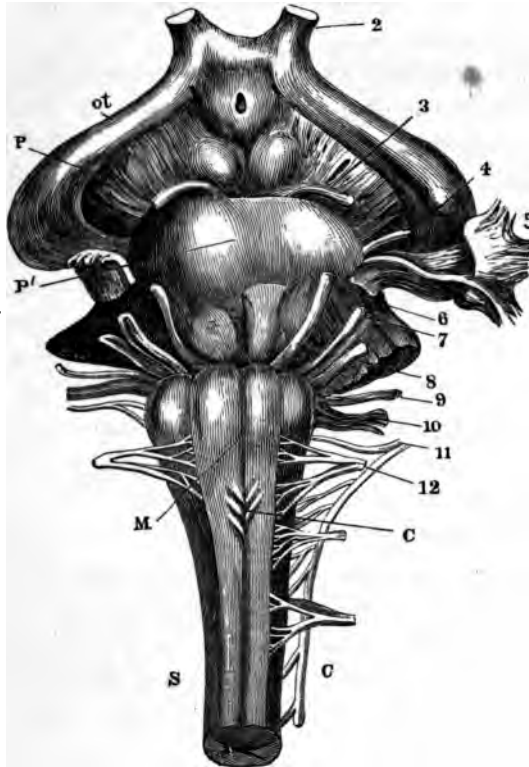
5. THE CEREBELLUM.

This organ was formerly believed to be the seat of the reproductive faculty and desire, but we look upon it now as the centre for the equilibration of the body. The most constant symptom of tumour of the cerebellum is giddiness; and where this symptom is present in asthenic patients without actual disease of the cerebellum, the semicircular canals, or the stomach, we may conclude that it is owing to functional debility of the cerebellum.

6. THE MESOCEPHALE.

The pons and optic lobes, which constitute the mesocephale, have, in addition to other functions, probably much to do with the emotions and affections, and constitute, perhaps, in connection with the occipital lobes, the *emotional centres*, for the feelings of fear, terror, pleasure, pain, etc. It is certain that they serve the expression of affections and emotions, such as laughing, crying, etc., which are generally quite involuntary, and independent

FIG. 7.



Upper portion of the spinal cord, medulla, and base of the Brain.

S C—Spinal cord, with nerves emerging from its side. C—Crossing of the fibres in the medulla. M—Medulla. P'—Pons. P—Peduncles of the brain. 2—Optic nerve. ot—Optic tracts. 3, 4, and 6—Nerves supplying the muscles of the eye, eyelid, and iris. 5—Nerve conferring sensibility on the face, taste on the anterior part of the tongue, and motive power on the muscles of mastication. 7—Nerve supplying the facial muscles. 8—Auditory nerve. 9—Nerve conferring taste on the posterior part of the tongue, and sensibility on the throat. 10—Pneumogastric nerve for the throat, windpipe, lungs, heart, and stomach. 11—Nerve for the muscles moving the head. 12—Nerve for the articulation of the tongue.

of the will, just as the emotions and affections themselves.

The symptoms which I would refer to failure of power in the emotional centres, are of the most manifold description. Many patients suffer from feelings of despair, hopelessness, want of confidence in their powers, of vague alarm, timidity in society, or dread of being alone; they are afraid of going out into a large place (Westphal's agoraphobia), or of being shut up in a narrow one; some are unable to stay indoors; others apprehend the impending invasion of certain diseases (hypochondriasis), or that the house is likely to be set on fire; some again fear to be obliged to jump out of an upper window, or to throw themselves down from a great height, such as from the top of steeples, columns, or gallery seats in a theatre, or there is the fear of being obliged to cut one's throat on seeing a knife, or to kill one's children, etc. Such morbid fears and emotions are of the most distressing character, and embitter for years the lives of many persons, who often find no sympathy either from friends or doctors. One patient expressed himself to the effect that "his suffering was unparalleled and unsurpassable. No description could give the faintest idea of the misery and distress from which he had suffered for the last thirty years. It would take a whole year to describe it; and a mere enumera-

tion of his awful symptoms would be like a drop to the ocean. He had tried every doctor of importance, had gone round the world, and spent a very large amount of money for the purpose of recovering his health, but all had been in vain ; every plan he had adopted had only made him worse. He was under the impression that no one had formed the least conception of his condition, which was darkness that might be felt. The doctors had been completely baffled, and now refused to give any opinion or advice in the matter." Such conditions occur rarely in organic disease of the brain and spinal cord, and are often traceable in men to sexual irregularities, such as masturbation and toying with women ; and in women to uterine disorders.

7. THE MEDULLA OBLONGATA.

(M. Fig. 7, p. 51.)

This organ is unquestionably the most vital portion of the whole body, and contains numerous centres of the utmost physiological importance crowded together in a small compass. Most of these centres may be separately or collectively affected by *asthenia*. Some forms of habitual cough, shortness of breath, liability to attacks of bronchitis, asthma, etc., are no doubt owing to failure of power in the *respiratory centre* in the medulla. The centre which

regulates the *heart's action* may be similarly affected ; for in many patients we find a tremulous, irregular, and easily compressible pulse, the rate of which may vary from 28 to 120 and more. In the majority of cases the pulse is accelerated, showing loss of the inhibitory power of the pneumogastric nerve, or rather of its centre in the medulla. Palpitation of the heart, more especially under the influence of the emotions, with pain and a feeling of oppression, are frequent, and sometimes there is a sudden stoppage of the heart's action, which produces a feeling as if one were going to die, and fainting fits.

The *vasomotor centre* in the medulla is likewise often in a weak and irritable condition, as shown by excessive blushing or pallor, induced by slight causes ; and this is often so annoying that many patients avoid society altogether. There are also feelings of chills or flushes in various parts of the body, and the blood supply is often unequal, so that some parts are much warmer than others ; thus one ear may feel burning hot, while the other is quite cold, etc.

The centres for the *insensible perspiration* of the skin and for the secretion of *saliva*, which are likewise situated in the medulla, may suffer in a similar manner. The skin, and also the mucous membranes of the eyes, nose, and mouth are often too dry ; while in other cases there is excessive sweat-

ing in the hands and feet, which may come on suddenly in consequence of an emotion, or be more or less permanent. The secretion of tears and saliva may also be too abundant; and there may be excessive sensitiveness to heat and cold.

The centres for *swallowing* and for *speech* are only rarely affected. Occasionally, however, there is difficulty of deglutition and a choking feeling in the throat, and the voice becomes feeble and hoarse. Symptoms of *nervous dyspepsia* are much more frequent, and are owing to failure of power in the nuclei of the pneumogastric nerves, on the floor of the fourth ventricle, in the medulla. In such cases there is no disease of the stomach, liver, or other portions of the alimentary canal; the tongue is clean, and the action of the bowels regular; yet there may be severe vomiting, nausea, loss of appetite, pain in, and distension of, the stomach. Vomiting is a frequent symptom of meningitis, tumour of the brain, and injury to the organ, more especially where all these influences act on the medulla; but it may also come on simply from anxiety and worry, without any coarse disease either in the medulla, the pneumogastric nerve or the stomach, uterus, or other parts. The pain is worse before meals, and is relieved by eating; it may be very intense, but may be forgotten by drawing the attention away from it; while in

disease of the stomach the pain is increased after food, and the symptoms are altogether more constant in their appearance. The pain is sometimes so severe that gallstones, ulceration, or cancer of the stomach are suspected; and the loss of appetite may be so great that emaciation of the whole body results from the want of nourishment. (anorexia nervosa). What little food is taken, is often not digested, and there may be constant feelings of malaise and exhaustion in the pit of the stomach, accompanied by yawning and sighing. Distension of the stomach, by loss of power in the muscular coat of the organ, conduces to flatulence, which is sometimes extreme; and attacks of diarrhœa are common.

The medulla also contains a nerve-centre for the *kidneys*, which regulates the secretion of the urine. Nerve-fibres proceed from this centre downwards to the dorsal portion of the spinal cord, from whence they pass through certain dorsal nerves, and accompanied by sympathetic fibres, reach the thoracic aorta, and then go on their way to the renal arteries and the kidneys. The influence of mental emotions on the flow of the urine is therefore easily explained by the intimate connection which exists between these centres in the medulla and the emotional centres in the mesocephale.

Claude Bernard first established the fact that

injury to a certain portion of the medulla causes a super-abundant flow of urine, which is generally, although not invariably, accompanied with the appearance of sugar in the urine. On the other hand a number of cases of *diabetes insipidus* have been recorded, in which lesions were discovered in the same organ. Simple loss of power in the renal centre of the medulla may also give rise to an unduly large secretion of the urine, of which the following is an example :—

CASE 9.—A gentleman, aged 37, single, consulted me on July 27, 1880. He had spent many years in the tropics, and had suffered from persistent diarrhoea, which nothing would arrest. This ultimately brought on a state of complete cerebral exhaustion, and he became quite unable to attend to his occupations. The most troublesome amongst the numerous symptoms from which he suffered, however, was that of excessive secretion of urine, which was so bad as to exclude him altogether from society. When in company, he could hardly sit still for a quarter of an hour without experiencing a most pressing desire to empty his bladder ; and this annoyance had led him to adopt a solitary mode of life. The average quantity of urine which he passed during the day amounted to ninety ounces, but it was often much more. It was feebly acid, had a low specific gravity, and contained nothing ab-

normal. As he had taken gallons of physic, without the slightest relief, he wished to ascertain from me whether any mode of applying galvanism might be expected to be of service to him. I looked upon the case as one of functional debility in the renal centre of the medulla, and directed the voltaic current to that organ, taking care that it received alternately the influence of the anode and cathode, and regulating the finer degrees of voltaic power by the rheostat. The application lasted altogether six minutes, and was entirely painless.

The patient came to see me again a week afterwards, and informed me that the result had been completely successful. The quantity of urine passed during the day had, after the application, fallen to thirty ounces; and while formerly he had often had incessant calls to pass water, he had since then only been obliged to pass it three times a day. I regret to say that I had not the opportunity of examining the urine more carefully, either before or after the application of electricity, and that I have since lost sight of the patient, so that I do not know whether the relief has continued. That the change which occurred so suddenly was really owing to the use of the galvanism seems obvious, as no medicine had been given, and the patient had not adopted any alteration in his diet or general regimen. The derangement of the medulla, and possibly of the

middle lobe of the cerebellum, which gave rise to the diabetes, must have been slight, but it was sufficient to render the patient thoroughly miserable, and might perhaps in course of time have developed into more serious structural changes in the organ.



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